



STUDY OF PHYSICO-CHEMICAL PARAMETERS OF TWO PONDS IN DARBHANGA DISTRICT OF BIHAR

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ABSTRACT

Fresh water resources are scattered throughout the district and are under fishculture on extensive or semi intensive way giving some income to the growers. The number of ponds, tanks, etc. has significantly increased in last few years. The development of fisheries in these fresh water resources is the present need using scientific techniques. There is no limnological study of fish pond has been made to improve the pond productivity. The abiotic and biotic factors of the water influence the quality and quantity of aquatic life surviving there. The role of water in nature is unique not only for human; but, also for the numerous organisms living in the water. The physical and chemical properties of fresh water bodies are characterized by the climatic, geochemical, geo morphological and pollution condition. In order to utilize fresh water bodies successfully for fish production, it is very important to study the Physico-Chemical factors influencing the biological productivity in the water bodies (Sahni and Yadav, 2012).

KEYWORDS: Water, Abiotic, Limnological, Climatic, Fish, Pollution

INTRODUCTION

Fish is one of the popularly consumed items in Bihar, particularly in Mithila region and it is the fastest growing sub sector indicating a growth rate of over 10 per cent per annum. An area of 1,13,664 ha is available in Bihar in the form of tanks/ponds, mauns (ox-bowlakes), chauras (flood plains) and reservoirs. In addition to this, there is big potential in the large low-lying area of about 3,38,745 ha, which can be suitably developed for various aquaculture activities. Against the huge water resources potential available, only 26,000 ha (7.68 per cent) of water areas have been developed for fish culture. Darbhanga is one of the fastest urbanizing city of north Bihar. To fulfill of water supply to its exploding population the pressure on ground water has been increasing constantly. Ground water pollution can occur where anthropogenic activity waste water is discharged into sewage drain, ponds and rivers. Water is the most vital resource for the existence of all life and ecosystems in Earth. Certain standards in terms of its physical, chemical and biological parameters determine its suitability for intended purposes. Water is considered polluted when these parameters shift from the acceptable range of quality standards (APHA, 2000). The pond water is generally used for domestic and fisheries activity. In India still now several researchers have done study on physico-chemical and biological characteristics of standing and running water resources (Kodarkar, 1992).

Fresh water resources are scattered throughout the district and are under fishculture on extensive or semi intensive way giving some income to the growers. The number of ponds, tanks, etc. has significantly increased in last few years. The development of fisheries in these fresh water resources is the present need using scientific techniques. There is no limnological study of fish pond has been made to improve the pond productivity. The abiotic and biotic factors of the water influence the

quality and quantity of aquatic life surviving there. The role of water in nature is unique not only for human; but, also for the numerous organisms living in the water. The physical and chemical properties of fresh water bodies are characterized by the climatic, geochemical, geo morphological and pollution condition. In order to utilize fresh water bodies successfully for fish production, it is very important to study the Physico-Chemical factors influencing the biological productivity in the water bodies (Sahni and Yadav, 2012). The quality of aquatic life surviving in the pond is totally dependent on the water quality of the pond. In the recent years several studies have been made in this field (Yadav et al., 2013) but not much information is available on Physico-Chemical and biological parameters of the present water bodies. The objective of this work has to analyze various physico-chemical parameters of the pond water at Darbhanga district of Bihar.

MATERIALS AND METHODS:

The water samples were collected from four different stations in the morning period around 8 to 12 am., in polythene bottle regularly for once in every month and samples brought into laboratory for the estimation of various physico-chemical parameters like water temperature, transparency, pH, were recorded at the time of collection, by using thermometer pocket digital pH meter, transparency was measured with the help of Secchi Disc while other parameters such as TDS, DO, BOD, free CO₂, chloride, carbonate, bicarbonate and magnesium were estimated in the laboratory by using standard methods as APHA (2000).

RESULTS AND DISCUSSIONS

The monthly variation of certain physico-chemical parameters of both ponds Mahadev Pokhar at Chunabhatthi and Jogiyahi Pokhar at Ranipur were observed is presented in tables as

follow.

Month	Water temperature °C	Transparence cm	TDS gm/ltr.	p ^H
Jan	18.00	42.5	0.37	8.5
Feb	20.5	47.2	0.39	8.6
March	26.5	44.9	0.4	7.6
April	27.5	60.8	0.3	7.7
May	23.5	66.3	0.6	7.2
June	34.5	61.2	2.1	7.4
July	34.0	59.1	1.12	7.3
Aug.	35.0	46.7	0.2	7.5
Sep.	30.5	45.8	0.3	7.6
Oct.	31.5	45.2	0.4	8.0
Nov.	29.5	45.1	1.8	8.1
Dec.	20.5	51.4	0.6	8.2

Table 1: Physical parameters of Mahadev Pokhar, Darbhanga

Month	Carbonate	Bicar-bonate	D.O.	Free CO ₂	BOD	Chloride	Magne-sium
Jan	3.01	112	9.0	0.01	34.50	28.10	8.30
Feb	2.3	114	8.50	0.86	42.04	33.45	8.50
March	0.0	109	9.8	4.00	49.50	40.10	14.0
April	0.001	257	6.2	5.28	72.05	43.40	16.42
May	0.001	162	6.5	9.40	154.0	46.3	12.40
June	0.0	394	5.3	10.48	152.87	34.00	9.20
July	0.001	206	10.1	18.10	25.5	28.25	10.40
Aug.	0.0	195	7.7	19.10	27.3	39.00	6.70
Sep.	0.0	177	7.0	16.57	39.4	36.41	4.10
Oct.	0.001	149	7.6	12.01	61.1	33.08	11.00
Nov.	2.4	150	8.0	14.50	21.25	26.25	11.08
Dec.	2.9	153	8.60	5.00	22.40	30.00	12.00

Table 2: Chemical parameters of Mahadev Pokhar, Darbhanga

Month	Water temperature °C	Transparence cm	TDS gm/ltr.	p ^H
Jan	11.0	51.0	1.37	8.4
Feb	25.5	58.1	1.39	8.1
March	26.0	73.0	0.6	7.5
April	28.0	73.5	0.4	8.0
May	34.1	83.2	1.2	8.1
June	35.0	77.1	1.8	8.3
July	32.4	76.0	1.40	7.7
Aug.	31.4	52.0	0.2	8.1
Sep.	28.0	53.0	2.3	8.0
Oct.	28.1	55.0	0.4	7.8
Nov.	27.8	53.0	0.8	8.1
Dec.	20.8	55.0	0.6	8.2

Table 3: Physical parameters of Jogiyahi Pokhar, Darbhanga

Month	Carbonate	Bicar-bonate	D.O.	Free CO ₂	BOD	Chloride	Magne-sium
Jan	3.21	124	9.0	0.10	39.50	32.10	17.30
Feb	4.10	106	8.50	0.16	41.04	36.45	11.50

March	4.01	154	10.49	7.0	25.50	44.10	17.00
April	0.00	155	6.7	7.08	74.05	46.40	19.48
May	0.00	225	7.3	20.40	124.0	40.49	15.40
June	0.00	234	5.8	13.41	125.7	38.00	12.20
July	0.01	195	6.18	12.10	20.5	34.25	13.40
Aug.	0.00	135	8.1	11.10	29.3	43.00	9.70
Sep.	0.00	147	7.5	12.57	32.4	50.41	7.10
Oct.	0.01	139	8.1	7.01	43.1	37.08	14.00
Nov.	4.00	110	8.4	3.50	25.25	30.25	15.08
Dec.	3.0	115	9.0	1.00	25.40	34.00	10.90

Table 4: Chemical parameters of Jogiyahi Pokhar, Darbhanga

DISCUSSION

The physico-chemical analysis of the two ponds water has been made during different season of a year of observation. The detail of observation may be discussed in relation to the previous works done by the different workers.

Temperature:

Water temperature of Mahadev pond was recorded maximum in month of June (summer) 34.5°C and in January (winter) 18 °C while in Jogiyahi pond maximum in month of June (summer) 35.0°C and in January (winter) 19 °C. Temperature is amongst one of the important factors that has direct effect over the survival and existence of living organisms as well as physico-chemical quality of water. Temperature of the pond water showed typical seasonal fluctuation as it was recorded maximum in summer and minimum in winter. Yearly mean of the temperature was observed higher in pond water during the summer but lower in winter. Vyas and Kumar (1968) have found similar results.

Transparency:

Water transparency of Mahadev pond was recorded maximum in month of May (summer) 66.3 cm and in January (winter) 42.5 cm while in Jogiyahi pond maximum in month of May (summer) 82.2 cm and in January (winter) 51 cm. higher transparency occur during winter and summer due to absence of rain, runoff and flood water as well as gradual setting of suspended particles. Higher transparency in winter was also reported by Bhatt et al. (1985). However, Towhead et al. (1988) observed maximum transparency during the winter. Minimum transparency was observed during the rains, has also been observed by several investigators including Bhatt et al. (1985) and Towhead et al. (1988).

p^H:

Water p^H of Mahadev pond was recorded minimum in month of May (summer) 7.2 and in January (winter) 8.6 while in Jogiyahi pond minimum in month of March (summer) 7.5 cm and in January (winter) 8.3. Most commonly it varies between 7 and 9. In commonest water, p^H is slightly alkaline due to the presence of bicarbonates and carbonates of alkaline earth. Seulpthorpe (1976) has suggested that p^H and carbon dioxide are even more critical factors in the survival of aquatic plant and fishes than the oxygen supply. Alternations in p^H in natural waters are usually accompanied by changes in other physico-chemical

factors also. It is therefore very essential to monitor the level of pH in a given water body regularly in view of its implication. Its level fluctuated in within a narrow range in conformity with the findings of various workers (Hosmani and Bharati, 1980).

TDS:

TDS of Mahadev pond water was recorded maximum in month of June (rainy season) 2.1 gm/L and in April (before summer) 0.2 gm/L while in Raj pond maximum in month of July (rainy season) 1.40 gm/L (before summer) 0.5 gm/L. It is due to heavy rainfall. Similar records were observed to reported by Verma and Munshi (1987) and Towheed et al. (1988).

Do:

The amount of oxygen in water depends on the surface area exposed, temperature and salinity. Water, where organic matter is very high, has very little oxygen dissolved in it and self-purification of water system depends on the presence of sufficient amount of oxygen dissolved in it. Dissolved Oxygen was found to be maximum during the winters in both ponds. This can be attributed to the prevailing lower temperature. Solubility of oxygen is dependent on temperature and it increases with decrease in water temperature (Clarke, 1965). Higher amount of dissolved oxygen during the winters have also been reported by Vyas and Kumar (1968), Bhatt et al. (1985) and Towheed et al. (1988). Minimum content of Dissolved Oxygen was observed during the rains and summers, a result also observed by Verma and Munshi (1987) and Towheed et al. (1988).

BOD:

Biological Oxygen Demand is an important parameter for assessing water quality. When oxygen is used up faster than it is replaced, the water quality begins to deteriorate. Water BOD of Mahadev pond was recorded maximum in month of June (summer) 154.7 ppm and minimum in November (winter) 21.20 ppm and rainy season while in Jogiyahi pond maximum in month of June (summer) 125.7 ppm and in July (rainy season) 20 ppm occur during rainy season due to runoff water. The similar result also observed by Verma and Munshi (1987) and Towheed et al. (1988).

Carbonate & Bicarbonate:

Seasonal mean was maximum in winter and minimum in summer in both ponds water. Carbonate alkalinity was low whereas bicarbonate alkalinity was recorded fairly high. The lower levels carbonate alkalinity and higher level of bicarbonate alkalinity can be attributed to the pH range which favours more CO₂ to be present as HCO₃ ion (Clarke, 1965). High value of bicarbonate alkalinity in polluted water have been reported by Singh (1985) and Sahay et al. (1985). Based on alkalinity values, Moyle (1946) classified water into three categories : low productive with less than 20 ppm alkalinity, low to medium with 20-40 ppm alkalinity and medium to high with 40-90ppm alkalinity. Philipose (1959) categories Indian water as low productive having 40-50 alkalinity, moderately high with 50-100 ppm alkalinity and fairly high with 100-200 ppm alkalinity. On the basis of these classifications, the pond under study appear to be of good productive value. The property of water which prevents leather formation with soap is called hardness

and is mainly caused by the calcium and magnesium cations. However, other cations and anions also contribute to hardness. Hard water is not suitable for various domestic purposes. It has no adverse effect on health but highest desirable limit of 100 mg/l and maximum permissible limit of 500 mg/l have been set by WHO for drinking water. However, Ministry of Works and Housing (1975) considers 200 mg/l as acceptable and a concentration of 600 mg/l as cause of rejection.

CO₂:

Water with concentration of free CO₂ less than 5ppm supports good fish production, where as its high concentration in water leads to asphyxiation and obtain death of fishes. As far as prediction of the trophic status of a water body on the basis of recording of annual mean values of free CO₂ is concerned, there are difference in opinions. Yadava et al. (1987) and Hosmani (1988) have observed decrease value of free CO₂ in eutrophic and polluted water bodies and on the other hand Hosmani and Bharti (1980), Mesfin and Belay (1989), Rana and Palria (1998), have ascertained lower free CO₂ content at unpolluted sites. Thus, CO₂ concentration appears to be no yard stick for predicting either the trophic level or magnitude of pollution of any water body.

Chloride:

Water BOD of Mahadev pond was recorded maximum in month of Sep.(summer) 46.4 ppm and minimum in November (winter) 26.25 ppm while in Jogiyahi pond maximum in month of Sep. (summer) 50.40 ppm and in January (winter) 32.10 ppm occur. None of the values exceeded desirable standard (200ppm) of WHO and Ministry of Works and Housing in the water of pond and river. High chloride content in the polluted water has been reported by Venue et al. (1984), Singh (1985), High chloride content in the polluted water has been reported Venue et al. (1984), Singh (1985) and Rana and Palria (1988) .

Magnesium:

Magnesium is an important major nutrient needed by all organisms, since it activates many enzyme systems. It is an essential constituent of the chlorophyll and is also involved in phosphorus transfer process. It is particularly associated with clay. It plays an important role in synthesis of ATP and ADP and inorganic phosphates. It is also an activator for many of the enzymes involved in carbohydrate metabolism. In the present study, yearly mean of magnesium was found to be lower in the rainy season and higher in winter. The highest desirable limit of magnesium in drinking water prescribed by WHO and acceptable limit to Ministry of Works and Housing is 30ppm. Singh (1992) recorded minimum magnesium level during monsoon months and the maximum in the month of February. Therefore, it may be concluded that the both ponds water under study is not polluted as far as magnesium is concerned.

CONCLUSION

Observed values of Mahadev pond water on Temperature, magnesium, carbonate, chloride, BOD and free CO₂ were found comparatively higher than that of Jogiyahi pond, whereas pH, Transparency, Dissolved Oxygen and bicarbonate of Mahadev pond water were found lower than the Jogiyahi pond.

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